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Assumptions to the Annual Energy Outlook 2009

Table 6.3. Coefficients for Technology Possibility Curve for all Industrial Scenarios (applies to all fuels unless specified)

Industry/Process Unit	Existing Facilities				New Facilities				
	Reference REI 2030 ¹	HighTech REI 2030 ¹	Reference TPC ² (%)	High Tech TPC ² (%)	REI 2002 ³	Reference REI2030 ⁴	High Tech REI2030 ⁴	Reference TPC ²	High Tech TPC ² (%)
Food Products									
Process Heating	0.900	0.890	-0.376	-0.414	0.900	0.800	0.781	-0.420	-0.504
Process Heating-Steam	0.810	0.792	-0.751	-0.828	0.900	0.711	0.678	-0.840	-1.007
Process Cooling-Electricity	0.875	0.863	-0.476	-0.524	0.850	0.750	0.731	-0.446	-0.535
Process Cooling-Natural Gas	0.900	0.890	-0.376	-0.414	0.900	0.800	0.781	-0.420	-0.504
Other-Electricity	0.914	0.906	-0.321	-0.353	0.915	0.810	0.790	-0.434	-0.521
Other-Natural Gas	0.900	0.890	-0.376	-0.414	0.900	0.800	0.781	-0.420	-0.504
Paper & Allied Products									
Wood Preparation	0.792	0.747	-0.831	-1.038	0.882	0.701	0.532	-0.818	-1.791
Waste Pulpding-Electricity	0.936	0.898	-0.236	-0.382	0.936	0.936	0.800	-0.000	-0.559
Waste Pulpding-Steam	0.876	0.898	-0.472	-0.382	0.936	0.936	0.800	-0.000	-0.559
Mechanical Pulpding-Electricity	0.816	0.771	-0.724	-0.925	0.931	0.701	0.580	-0.007	-1.673
Mechanical Pulpding-Steam	0.665	0.771	-1.448	-0.925	0.931	0.527	0.580	-2.014	-1.673
Semi-Chemical-Electricity	0.954	0.948	-0.168	-0.191	0.971	0.937	0.777	-0.126	-0.792
Semi-Chemical-Steam	0.910	0.948	-0.335	-0.191	0.971	0.905	0.777	-0.253	-0.792
Kraft, Sulfite, Misc. Chemicals	0.870	0.827	-0.494	-0.675	0.914	0.827	0.549	-0.356	-1.806
Kraft, Sulfite, Misc. Chemicals-Steam	0.757	0.827	-0.989	-0.675	0.914	0.748	0.549	-0.712	-1.806
Bleaching-Electricity	0.798	0.758	-0.801	-0.986	0.878	0.719	0.627	-0.713	-1.196
Bleaching-Steam	0.636	0.758	-1.601	-0.986	0.878	0.587	0.627	-1.426	-1.196
Paper Making	0.869	0.766	-0.502	-0.949	0.885	0.852	0.451	-0.137	-2.380
Paper Making-Steam	0.965	0.766	-1.004	-0.949	0.885	0.820	0.451	-0.273	-2.380
Bulk Chemicals									
Process Heating	0.900	0.890	-0.376	-0.417	0.900	0.800	0.781	-0.420	-0.503
Process Heating-Steam	0.655	0.624	-1.508	-1.668	0.720	0.448	0.407	-1.679	-2.014
Process Heating-Natural Gas	0.810	0.791	-0.751	-0.834	0.720	0.569	0.542	-0.840	-1.007
Process Cooling-Electricity	0.875	0.862	-0.476	-0.528	0.850	0.750	0.731	-0.446	-0.535
Process Cooling-Natural Gas	0.900	0.890	-0.376	-0.417	0.900	0.800	0.781	-0.420	-0.503
Electro-Chemical	0.980	0.978	-0.072	-0.080	0.950	0.850	0.831	-0.396	-0.476
Other	0.900	0.890	-0.376	-0.417	0.900	0.800	0.781	-0.420	-0.503
Other-Electricity	0.914	0.905	-0.321	-0.356	0.915	0.810	0.790	-0.434	-0.521
Other-Natural Gas	0.810	0.791	-0.751	-0.834	0.720	0.569	0.542	-0.840	-1.007
Glass & Glass Products⁵									
Batch Preparation-Electricity	0.941	0.941	-0.217	-0.217	0.882	0.882	0.819	0.000	-0.264
Melting/Refining	0.934	0.822	-0.424	-0.700	0.900	0.868	0.449	-0.129	-2.453
Melting/Refining-Steam	0.872	0.822	-0.487	-0.700	0.900	0.837	0.449	-0.258	-2.453
Forming	0.984	0.965	-0.058	-0.129	0.982	0.968	0.826	-0.050	-0.614
Forming-Steam	0.968	0.965	-0.115	-0.129	0.982	0.955	0.826	-0.100	-0.614
Post-Forming	0.977	0.971	-0.081	-0.107	0.968	0.955	0.865	-0.047	-0.398
Post-Forming-Steam	0.955	0.971	-0.162	-0.107	0.968	0.943	0.865	-0.093	-0.398
Cement									
Dry Process	0.905	0.800	-0.356	-0.794	0.900	0.810	0.531	-0.376	-1.869
Wet Process ⁶	0.951	0.894	-0.178	-0.398	NA	NA	NA	NA	NA
Wet Process-Steam ⁶	0.905	0.850	-0.356	-0.579	NA	NA	NA	NA	NA
Finish Grinding-Electricity	0.975	0.850	-0.090	-0.579	0.950	0.950	0.600	0.000	-1.628
Iron and Steel									
Coke Oven ⁶	0.935	0.845	-0.242	-0.600	0.902	0.869	0.637	-0.133	-1.235
Coke Oven-Steam ⁶	0.873	0.845	-0.483	-0.600	0.902	0.837	0.637	-0.266	-1.235
BF/BOF	0.994	0.950	-0.023	-0.183	0.987	0.987	0.785	0.000	-0.812
BF/BOF-Steam	0.987	0.950	-0.047	-0.183	0.987	0.987	0.785	0.000	-0.812
EAF	0.925	0.845	-0.280	-0.600	0.990	0.849	0.655	-0.547	-1.463
Ingot Casting/Primary Rolling ⁶	1.000	1.000	0.000	0.000	NA	NA	NA	NA	NA
Continuous Casting ⁷	1.000	1.000	0.000	0.000	1.000	1.000	1.000	0.000	0.000

Table 6.3. Coefficients for Technology Possibility Curve for all Industrial Scenarios (applies to all fuels unless specified) (continued)

Industry/Process Unit	Existing Facilities				New Facilities				
	Reference REI 2030 ¹	Reference REI 2030 ¹	High Tech REI2030 ¹	Reference TPC ² (%)	Reference REI 2002 ³	Reference REI/2030 ⁴	High Tech REI2030 ⁴	Reference TPC ²	High Tech TPC ² (%)
Hot Rolling ⁷	0.826	0.761	-0.680	-0.973	0.800	0.652	0.337	-0.728	-3.040
Hot Rolling-Steam ⁷	0.681	0.761	-1.361	-0.973	0.800	0.531	0.337	-1.456	-3.040
Cold Rolling ⁷	0.737	0.706	-1.084	-1.236	0.924	0.474	0.400	-2.356	-2.946
Cold Rolling-Steam ⁷	0.541	0.706	-2.168	-1.236	0.924	0.239	0.400	-4.712	-2.946
Aluminum									
Alumina Refining	0.930	0.915	-0.260	-0.317	0.900	0.860	0.576	-0.164	-1.580
Alumina Refining-Steam	0.864	0.800	-0.519	-0.794	0.900	0.821	0.494	-0.328	-2.117
Primary Smelting	0.900	0.800	-0.376	-0.794	0.950	0.800	0.522	-0.612	-2.117
Primary Smelting-Steam	0.810	0.800	-0.751	-0.794	0.950	0.673	0.522	-1.224	-2.117
Secondary	0.875	0.825	-0.476	-0.685	0.850	0.750	0.376	-0.446	-2.869
Semi-Fabrication, Sheet	0.900	0.750	-0.376	-1.022	0.900	0.800	0.457	-0.420	-2.389
Semi-Fabrication, Other	0.925	0.825	-0.278	-0.685	0.950	0.850	0.467	-0.396	-2.505
Metal-Based Durables									
Fabricated Metals									
Process Heating	0.728	0.704	-1.127	-1.245	0.675	0.420	0.380	-1.679	-2.032
Process Cooling-Electricity	0.669	0.647	-1.427	-1.545	0.638	0.385	0.348	-1.784	-2.137
Process Cooling-Natural Gas	0.728	0.704	-1.127	-1.245	0.675	0.420	0.380	-1.679	-2.032
Other	0.728	0.704	-1.127	-1.245	0.675	0.420	0.380	-1.679	-2.032
Other-Electricity	0.763	0.738	-0.962	-1.080	0.686	0.420	0.380	-1737	-2.091
Machinery									
Process Heating	0.728	0.704	-1.127	-1.245	0.675	0.330	0.284	-2.519	-3.048
Process Cooling-Electricity	0.669	0.647	-1.427	-1.545	0.638	0.298	0.256	-2.676	-3.206
Process Cooling-Natural Gas	0.728	0.704	-1.127	-1.245	0.675	0.330	0.284	-2.519	-3.048
Other	0.728	0.704	-1.127	-1.245	0.675	0.330	0.284	-2.519	-3.048
Other-Electricity	0.763	0.738	-0.962	-1.080	0.686	0.328	0.281	-2.606	-3.136
Computers and Electronics									
Process Heating	0.810	0.792	-0.751	0.830	0.720	0.569	0.541	-0.840	-1.016
Process Cooling-Electricity	0.765	0.748	-0.952	1.030	0.680	0.529	0.503	-0.892	-1.069
Process Cooling-Natural Gas	0.810	0.792	-0.751	0.830	0.720	0.569	0.541	-0.840	-1.016
Other	0.810	0.792	-0.751	0.830	0.720	0.569	0.541	-0.840	-1.016
Other-Electricity	0.835	0.817	-0.641	0.720	0.732	0.573	0.545	-0.869	-1.045
Electrical Equipment									
Process Heating	0.810	0.792	-0.751	0.830	0.720	0.569	0.541	-0.840	-1.016
Process Heating-Steam	0.655	0.626	-1.502	-1.660	0.720	0.448	0.405	-1.679	-2.032
Process Cooling-Electricity	0.765	0.748	-0.952	-1.030	0.680	0.529	0.503	-0.892	-1.069
Processing Cooling-Natural Gas	0.810	0.792	-0.751	-0.830	0.720	0.569	0.541	-0.840	-1.016
Other	0.810	0.792	-0.751	-0.830	0.720	0.569	0.541	-0.840	-1.016
Other-Electricity	0.835	0.817	-0.641	-0.720	0.732	0.573	0.545	-0.869	-1.045
Transportation Equipment									
Process Heating	0.863	0.849	-0.526	-0.581	0.765	0.633	0.609	-0.672	-0.813
Process Heating-Steam	0.744	0.721	-1.052	-1.162	0.765	0.524	0.483	-1.343	-1.626
Process Cooling-Electricity	0.829	0.817	-0.666	-0.721	0.723	0.591	0.568	-0.714	-0.855
Process Cooling-Natural Gas	0.863	0.849	-0.526	-0.581	0.765	0.633	0.609	-0.672	-0.813
Other	0.863	0.849	-0.526	-0.581	0.765	0.633	0.609	-0.672	-0.813
Other-Electricity	0.882	0.868	-0.449	-0.504	0.778	0.640	0.615	-0.695	-0.836

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Industry/Process Unit	Existing Facilities				New Facilities				
	Reference REI 2030 ¹	Reference REI 2030 ¹	High Tech REI2030 ¹	Reference TPC ² (%)	Reference REI 2002 ³	Reference REI2030 ⁴	High Tech REI2030 ⁴	Reference TPC ²	High Tech TPC ² (%)
Other Non-Intensive Manufacturing									
Wood Products									
Process Heating	0.728	0.705	-1.127	-1.241	0.630	0.392	0.356	-1.679	-2.021
Process Heating-Steam	0.528	0.495	-2.253	-2.481	0.630	0.242	0.198	-3.358	-4.041
Process Cooling-Electricity	0.669	0.647	-1.427	-1.541	0.595	0.359	0.326	-1.784	-2.126
Process Cooling-Natural Gas	0.728	0.705	-1.127	-1.241	0.630	0.392	0.356	-1.679	-2.021
Other	0.728	0.701	-1.127	-1.260	0.630	0.392	0.357	-1.679	-2.009
Other-Electricity	0.763	0.661	-0.962	-1.469	0.641	0.392	0.352	-1.737	-2.112
Plastic Products									
Process Heating	0.810	0.793	-0.751	-0.827	0.675	0.533	0.508	-0.840	-1.010
Process Heating-Steam	0.655	0.627	-1.502	-1.654	0.675	0.420	0.381	-1.679	-2.021
Process Cooling-Electricity	0.765	0.749	-0.952	-1.027	0.638	0.496	0.473	-0.892	-1.063
Process Cooling-Natural Gas	0.810	0.793	-0.751	-0.827	0.675	0.533	0.508	-0.840	-1.010
Other	0.810	0.790	-0.751	-0.840	0.675	0.533	0.509	-0.840	-1.005
Other-Electricity	0.835	0.759	-0.641	-0.980	0.686	0.538	0.510	-0.869	-1.056
Balance of Manufacturing									
Process Heating	0.690	0.665	-1.315	-1.447	0.675	0.373	0.330	-2.099	-2.526
Process Heating-Steam	0.474	0.439	-2.629	-2.895	0.675	0.203	0.158	-4.198	-5.052
Process Cooling-Electricity	0.625	0.602	-1.665	-1.798	0.638	0.339	0.300	-2.230	-2.657
Process Cooling-Natural Gas	0.690	0.665	-1.315	-1.447	0.675	0.373	0.330	-2.099	-2.526
Other-Natural Gas	0.690	0.661	-1.315	-1.470	0.675	0.373	0.331	-2.099	-2.511

¹REI 2030 Existing Facilities = Ratio of 2030 energy intensity to average 2002 energy intensity for existing facilities.

²TPC = annual rate of change between 2002 and 2030.

³REI 2002 New Facilities = For new facilities, the ratio of state-of-the-art energy intensity to average 2002 energy intensity for existing facilities.

⁴REI 2030 New Facilities = Ratio of 2030 energy intensity for a new state-of-the-art facility to the average 2002 intensity for existing facilities.

⁵REI's and TPCs apply to virgin and recycled materials.

⁶No new plants are likely to be built with these technologies.

⁷Net shape casting is projected to reduce the energy requirements for hot and cold rolling rather than for the continuous casting step.

NA = Not applicable.

BF = Blast furnace.

BOF = Basic oxygen furnace.

EAF = Electric arc furnace.

Source: Energy Information Administration, *Model Documentation Report, Industrial Sector Demand Module of the National Energy Modeling System*, DOE/EIA-M064(2008) (Washington, DC, 2008).